Characteristics of structural adjustment of agricultural holdings in Slovenia

Charakteristiken der Strukturanpassung der landwirtschaftlichen Betriebe in Slowenien

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Zusammenfassung

Der vorliegende Beitrag versucht, eine empirische Einsicht in den Strukturveränderungsprozess der landwirtschaftlichen Betriebe in Slowenien wiederzugeben und mögliche zukünftige Strukturanpassungen des landwirtschaftlichen Sektors Sloweniens zu schätzen. Determinanten der Strukturänderungen des landwirtschaftlichen Sektors Sloweniens wurden mittels Applikation eines Betriebsmodells ausgeführt. Auf der Basis der statistischen Daten (1991 und 2000 Volkszählungsdaten) werden Betriebsüberleben und Wachstum analysiert. Die Determinanten des Betriebsüberlebens beziehen sich auf die individuellen Charakteristiken Betriebsleiter, allgemeine Betriebs- und Produktionscharakteristiken und Lokationscharakteristiken. Das Betriebswachstum ist zuerst mit der Anfangsgröße des Betriebs determiniert. In Zukunft ist die Polarisation der Betriebsgrößestruktur zu erwarten.

Schlagworte: Landwirtschaft, Strukturanpassungen, Betriebsmodell

Summary

The paper attempts to provide empirical insight to the process of structural changes on agricultural holdings in Slovenia and to assess the likely future dynamics of structural adjustments in Slovene agriculture. Determinants of structural change in Slovene agriculture are quantified by application of an agricultural household model analysing farm survival and growth, using the 1991 and 2000 Census data. The farm survival pattern is determined by individual characteristics of farm hold-

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ers, common characteristics of agricultural households, farm characteristics and locational characteristics. Farm growth is determined primarily by the initial farm size. In future, polarisation of farm size distribution can be expected.
Keywords: agriculture, structural adjustment, household model

1. Introduction

Throughout the socialist period, structural conditions in Slovene agriculture were remaining fairly static (KOVAČIČ, 1995). Farm structures were characterised by a duality. On one side, small-scale family farms were representing the prevalent share in land use, but were producing only about two thirds of agricultural output. On the other side, large state farms were operating on about 10 per cent of agricultural land, but producing a third of total agricultural output (OECD, 2001).

Entering the transition with uncompetitive agricultural sector characterised by diseconomies of scale and inefficient labour allocation, one would expect intensive consolidation of the remaining farms. The aggregate number of farms has indeed decreased by 22.9 per cent, whereas the impact in terms of decreased labour input was less distinctive (SORS, 2002).

To understand complexity of motives and interests related to structural change, one has to analyse microeconomic behaviour within the basic unit of agricultural production, i.e. agricultural households. The analysis should provide theoretically plausible and empirically verifiable explanations about (i) the impact of various determinants influencing the decision-making process about continuation and scope of agricultural production; (ii) the interactions between decision-making determinants and (iii) the implications for the future structural trends in terms of farm number and size distribution.

Besides the fact that little empirical insight to the process of structural change at the level of agricultural households is yet available, most of the existing analytical work in this field has been carried out in stable socio-economic and structural environments. Due to somewhat specific structural conditions, it was appealing to analyse the case of Slovenia. The research focus lies in the provision of empirical insight to the process of structural changes on agricultural holdings in Slovenia and to assess the likely future dynamics of structural adjustments in Slovene agriculture. The paper is structured as follows. It starts with the description of theoretical background of the analysis. This is followed by the description of dataset and the specification of empirical approach utilised. Main results are presented in a greater detail. The paper concludes with some broad comments and policy implications of the results.

2. Theoretical background

Two aspects of structural change are subject of empirical scrutiny: farm survival and growth.

In analysing farm survival, we are deriving from a hypothesis, that this process is a function, determined by the following variables: (i) individual characteristics of agricultural household members, especially farm holders *(I)*; (ii) common characteristics of agricultural households, such as e.g. size and age distribution *(HH)* (iii) farm characteristics *(F)*, and (iv) locational and local labour market characteristics *(LM)*. Algebraically, this can be denoted as:

$$SURV = f\,(I, HH, F, LM) \qquad (1)$$

The dependent variable applied in the farm survival model has binary outcomes: 0 in cases when farms have ceased with agricultural production and 1 when they have resumed it. In the model, we observe the latent dependent variable $SURV_i^*$. General form of the model of farm survival can be specified as described below:

$$SURV_i^* = \alpha + \beta_F X_F + \beta_I X_I + \beta_{HH} X_{HH} + \beta_{LM} X_{LM} + \varepsilon_i \qquad (2)$$

Starting point of the empirical analysis of farm growth consists of the test of explicit impact of the initial farm size (HALLAM, 1993). Between various alternative models attempting to explain firm growth, the Gibrat's law of proportionate growth is usually used as the starting point of empirical analyses of farm growth (WEISS, 1995; HALLAM, 1993; RIZOV AND MATHIJS, 2001). The Gibrat's law of proportionate growth is based upon a premise that growth is determined by stochastic factors, which are size-neutral. As a consequence of the impact of stochastic factors to farm growth one can infer that the size distribution will not be symmetric. The basic equation to test this law is:

$$\ln S_{it} = \alpha + \beta \ln S_{it-1} + \varepsilon \qquad (3)$$

where S_{it} represents the size of a farm i in the period t. As it can be revealed by the above equation, the process of farm growth is determined by three groups of factors: α as the rate of market growth, which is common to all farms. β represents the systematic tendency of farm and is dependent from the initial farm size and ε is a row vector of random factors influencing structural changes. The Gibrat's law of proportionate growth holds in the specific case, where the value of β in the estimated model is not significantly different than 1. Despite its triviality and a lack of microeconomic argumentation, the Gibrat's law of proportionate growth remains an important starting point for empirical analysis of farm growth.

As indicated by HALLAM (1993), farms are characterised by a complexity of factors that influence their size and growth. WEISS (1995) finds out that insight to the farm size structure in most cases reveals asymmetrical distribution. Such distributions are characteristic for conditions, where all farms are faced with similar conditions and their actual growth is determined by stochastic factors.

3. Model

Similar approach as in WEISS (1999) has been adopted in estimation of a model of farm survival and growth for Slovenia. This is a two-stage model, in which we first estimate probability of up-keeping of agricultural production during the analysed period ('farm survival'). This is complemented by a function of farm growth, estimated for farms that have survived.

As it is pointed out by HECKMAN (1979), there is a risk of obtaining biased results when using non-random selected data samples in the models analysing behavioural patterns. Econometric estimation of farm growth determinants is a typical case for this since the risk of obtaining biased results stems from sample attrition (farm growth can only be estimated for those farms that have survived). As a possibility to avoid this problem, HECKMAN (1979) proposes estimation of a two-stage model. The first stage entails a probit model estimating the probability of farm survival.

The dependent variable applied in the probit model (i.e. farm survival) has binary outcomes: 0 in cases when farms have ceased with agricultural production and 1 when they have resumed it. In the model, we observe the latent dependent variable y_i*. Its general form can be specified (MADDALA, 1999):

$$y_i^* = \beta' Xi + \varepsilon_i \quad , \qquad y_i = 1 \quad if \quad y_i^* > 0\,, otherwise \quad y_i = 0 \tag{4}$$

Stemming from the general specification of the model (equation (2)), the probability function of the model is as follows:

$$y_i^* = \beta' Xi + \varepsilon_i \quad , \qquad y_i = 1 \quad if \quad y_i^* > 0\,, otherwise \quad y_i = 0 \tag{5}$$

where Z represents the cumulative distribution function of the residual ε. Assumption of the probit model is that the probability function residuals are normally distributed. The model estimation procedure (i.e. maximising the probability function) is (GREENE, 1997):

$$P = \int_{-\infty}^{\beta' x_i} \phi\,(z_i)\, dz_i \tag{6}$$

Based on the probit model results, an inverse of the Mill's ratio λ_i (HECKMAN, 1979) is calculated for each observation. This is a monotonously decreasing function of probability that an observation is included in the sample for estimation of farm growth. According to HECKMAN (1979), it is defined as follows:

$$\lambda_i = \frac{\phi(Z_i)}{1 - \Phi(Z_i)} = \frac{\phi(Z_i)}{\Phi(-Z_i)} \tag{7}$$

where $\Phi(Z_i)$ represents the cumulative distribution function and $\phi(Z_i)$ function of the density of residual ε_i of the probability function of the probit model.

Estimates of λ_i are used as additional explanatory variables in the second stage of the analysis, which consists of a simple OLS estimation of a farm growth model. Inclusion of λ_i eliminates the bias of model results stemming from model attrition. An iterative procedure leads towards a corrected estimation of farm growth function and consecutively, towards a quantification of farm growth determinants.

4. Data

The analysis utilises a 1991 Census and 2000 Agricultural census panel dataset for 92,685 agricultural households. In estimation of the farm growth model, we have decided to limit ourselves only to the growth in terms of livestock status. This has inevitably led to a reduction of the original dataset by 17,116 observations, which have reported no animal production in 1991.

Same model estimation procedure was carried out on three different sets of data. Besides the whole sample, two other subsets were utilised.

Both cases refer to the farms where the holder was still active on the labour market in 1991; in the first case, the holder was employed on the farm, whereas in the other one, the holder was employed off-farm. This has enabled to test whether there are any differences in the patterns of structural adjustment between different farm types.

Apart from the prior employment status, empirical analysis attempts to explain farm survival and growth pattern by quantifying impact of other determinants influencing labour allocation. These determinants can be formally put into two groups: (i) those affecting the marginal rate of substitution between labour and income (hence, personal and household characteristics) and (ii) those affecting labour productivity on the farm (hence, farm and personal characteristics) and off the farm (hence, labour market and personal characteristics). Besides the agricultural holding-related data, empirical analysis was augmented also by some secondary statistical data representing locational characteristics and regional characteristics regarding the general economic standard and labour market conditions. Conditions for agricultural production have been estimated by a dummy variable referring to location of farm in the Less Favoured Area. Coefficient of regional average gross income tax basis has been used as an indicator of general economic development. Conditions of the local labour market have been illustrated by the coefficient of regional unemployment rate and by the share of active population employed in agriculture.

Definitions and descriptive statistics of variables used in the estimation of the farm survival and growth model are presented in the Table 1.

In the observed dataset, 11.1 per cent of farm holdings have ceased to operate in the period 1991-2000, which is in some contrast with the Census data revealing only 77.1 per cent farm survival in that period (SORS, 2002). In terms of farm size, the sample does not deviate significantly from the Census data (average farm size 4.1 ha UAA, livestock status 4.6 LU; KOVAČIČ et al., 1995). Similar holds for the farm size distribution, which is asymmetric and skewed to the right. The skew ness coefficient is 6.76.

Consecutively to cessation of agricultural production in some farms, the remaining ones have grown by about one fifth. As it is revealed by the Table 1, farm growth tends to be more distinctively expressed in the cases where farm holders were in active employment in 1991.

Table 1: Model of survival and growth of farm holdings: definition of variables and descriptive statistics

		Holder employed on-farm in 1991		**Holder employed off-farm in 1991**	
Variable	**Symbol**	**Survival Average (st. dev.)**	**Cessation Average (st. dev.)**	**Survival Average (st. dev.)**	**Cessation Average (st. dev.)**
Number of observations	-	31,736	3,519	19,945	1,967
Share of farms survived in 1991-2000	*SURV*	1.00 (0.00)	0.00 (0.00)	1.00 (0.00)	0.00 (0.00)
Farm size in 1991 (ha UAA)	*UAA*	5.66 (4.66)	3.25 (3.06)	4.12 (3.71)	2.48 (2.59)
Farm size in 1991 (LU)	*LU*	6.22 (6.40)	2.56 (3.26)	3.71 (4.38)	1.68 (2.23)
Farm growth 1991-2000 (in percent)	*F_GRTH*	0.30 (7.42)	-0.10 (0.15)	0.56 (6.04)	-1.00 (0.02)
Age of farm holders	*AGE*	55.0 (11.27)	60.7 (9.80)	42.9 (9.92)	42.8 (10.51)
Farm transfers DV 1991-2000 (1=Y)	*F_TRANS*	0.32 (0.47)	0.00 (0.02)	0.23 (0.42)	0.00 (0.03)
Marriage status of farm holders (1 = married)	*MARR*	0.73 (0.44)	0.57 (0.50)	0.82 (0.38)	0.71 (0.46)
DV Educational attainment of farm holders (primary education)	*H_ED_P*	0.86 (0.35)	0.87 (0.34)	0.57 (0.50)	0.54 (0.50)
DV Educational attainment of farm holders (secondary education)	*H_ED_S*	0.11 (0.31)	0.10 (0.30)	0.33 (0.47)	0.32 (0.47)
DV Educational attainment of farm holders (tertiary education)	*H_ED_T*	0.04 (0.19)	0.04 (0.19)	0.10 (0.30)	0.14 (0.35)
DV farm holders active on the labour market	*H_ACT*	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
DV farm holders employed off-farm	*H_OFF*	0.00 (0.00)	0.00 (0.00)	1.00 (0.00)	1.00 (0.00)
DV farm holders employed on-farm	*H_FARM*	1.00 (0.00)	1.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Coefficient of population density (Slo=1)	*I_PDENS*	0.10 (1.07)	1.09 (1.16)	1.07 (1.23)	1.24 (1.44)
Coefficient of unemployment rate (Slo=1)	*I_UNMP*	1.14 (0.31)	1.18 (0.32)	1.08 (0.31)	1.14 (0.32)
Share of active population in agricultural employment	*AP_AGR*	5.12 (3.50)	5.12 (3.370)	4.27 (2.94)	4.30 (2.94)
Coefficient of gross income tax basis (Slo=1)	*I_GIT*	0.92 (0.14)	0.91 (0.14)	0.94 (0.15)	0.93 (0.15)
DV location of farm in a Less Favoured Area	*LFA*	0.81 (0.39)	0.74 (0.44)	0.81 (0.39)	0.75 (0.44)
Location in Centr. Slovenia	*C_SLO*	0.10 (0.29)	0.07 (0.26)	0.12 (0.33)	0.09 (0.28)
Location in West. Slovenia	*W_SLO*	0.16 (0.36)	0.17 (0.38)	0.19 (0.39)	0.21 (0.41)
Location in East. Slovenia	*E_SLO*	0.75 (0.44)	0.75 (0.43)	0.68 (0.47)	0.70 (0.46)

Source of data: SORS (2001)

The average age of farm holders in the observed dataset is relatively high. As expected, these figures are markedly lower in the cases where farm holders were employed in 1991.

In the analysed period, farm transfer (including succession and other types of farm transfer) has taken place on almost a third of agricultural holdings. The number of farm transfers in the case of farms that have ceased with agricultural production is practically negligible.

Although the whole dataset reflects unfavourable situation with respect to the educational attainment of farm holders, there are marked differences between the farm types. The highest share of farm holders with finished grammar school or less can be perceived in the case of farms whose farm holders were employed on the farm in 1991.

The data about inclusion of farm holders to the labour market, used as a dummy variable in the model, refers to those with active employment status, as also the others formally included in the labour market (i.e. also unemployed and those with temporarily discontinued employment). This explains the difference between the sum of the share of holders employed on- and off-farm and the share of farm holders active on the labour market.

5. Results

5.1 General characteristics of the model

Table 2 presents the parameter estimates of four alternative models of farm survival and growth. The first and the second model refer to the whole dataset, the only difference being inclusion of the data on the past employment status of farm holder in the Model 2. This serves as a test of significance (and actual impact) of the holder's past employment status on decisions linked to farm survival and growth. As already indicated in the previous section, we were also interested in detecting potential differences in behavioural patterns between agricultural households with farm holders employed on the farm with those with farm holders employed off the farm. This has been analysed by estimation of the Models 3 and 4.

Table 2: Model of survival and growth of farm holdings (farm size expressed in Livestock Unit Equivalents, t-values in parentheses)

	All farms	**All farms**	**Holder employed on-farm in 1991**	**Holder employed off-farm in 1991**
Explanatory variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Probit equation (Y1=farm survival)				
Constant	-1.75 (-6.94)	-1.83 (-7.17)	-1.94 (-4.84)	-1.78 (-3.53)
H_OFF	-	0.15 (4.68)	-	-
H_FARM	-	0.09 (2.74)	-	-
L_LU	0.38 (59.00)	0.38 (58.27)	0.40 (39.98)	0.36 (29.78)
AGE	3.16 (22.54)	3.21 (22.42)	3.16 (10.63)	2.90 (8.18)
AGE_2	-1.55 (-29.29)	-1.56 (-29.16)	-1.63 (-14.83)	-1.34 (-8.36)
H_ED_P	-0.04 (-1.80)	-0.02 (-1.17)	-0.03 (-0.68)	-0.06 (-1.78)
H_ED_S	-0.12 (-3.51)	-0.11 (-3.47)	-0.03 (-0.45)	-0.16 (-3.64)
H_ED_T	0.20 (12.56)	0.19 (12.20)	0.18 (7.79)	0.35 (10.90)
F_TRANS	3.36 (32.75)	3.35 (32.67)	3.34 (11.34)	2.30 (13.60)
H_ACT	0.04 (2.04)	-0.05 (-1.32)	-	-
I_PDENS	-0.01 (-1.64)	-0.01 (-1.61)	0.00 (0.07)	-0.03 (-2.20)
I_UNMP	-0.25 (-5.73)	-0.24 (-5.47)	-0.26 (-4.04)	-0.24 (-2.86)
AP_AGR	0.02 (5.27)	0.02 (5.26)	0.02 (5.12)	0.02 (3.07)
I_GIT	0.66 (3.99)	0.66 (3.98)	0.75 (3.04)	0.66 (2.10)
LFA	0.08 (3.48)	0.08 (3.53)	0.11 (3.48)	0.04 (1.00)
C_SLO	0.35 (2.80)	0.34 (2.66)	0.55 (2.94)	0.38 (1.42)
W_SLO	0.45 (3.57)	0.43 (3.44)	0.71 (3.81)	0.48 (1.78)
E_SLO	0.73 (5.42)	0.71 (5.29)	0.95 (4.78)	0.79 (2.82)
OLS equation (Y2=farm growth in %)				
Constant	3.04 (1.20)	3.55 (1.40)	4.51 (1.11)	1.31 (0.24)
H_OFF	-	0.04 (0.24)	-	-
H_FARM	-	0.39 (2.32)	-	-
L_LU	-0.95 (-11.10)	-0.97 (-11.40)	-1.11 (-6.16)	-0.87 (-7.23)
L_LU_2	0.56 (15.90)	0.55 (15.74)	0.43 (7.56)	0.72 (17.07)
L_LU_3	-0.09 (-5.11)	-0.09 (-5.26)	-0.05 (-1.57)	-0.16 (-10.26)
AGE	-2.23 (-2.95)	-2.49 (-3.30)	-3.23 (-1.27)	-1.52 (-0.61)
AGE_2	0.53 (1.53)	0.55 (1.62)	0.68 (0.65)	0.42 (0.35)
H_ED_P	0.14 (1.72)	0.10 (1.14)	0.03 (0.16)	0.04 (0.31)
MARR	0.10 (0.92)	0.14 (1.25)	0.22 (1.17)	0.22 (0.99)
F_TRANS	0.15 (0.66)	0.15 (0.67)	0.08 (0.18)	0.17 (0.48)
H_ACT	0.01 (0.03)	-0.30 (-1.30)	-	-
I_PDENS	-0.06 (-0.86)	-0.06 (-0.87)	-0.08 (-0.62)	-0.03 (-0.35)
I_UNMP	0.04 (0.17)	0.03 (0.12)	0.42 (0.82)	-0.56 (-1.39)
AP_AGR	-0.07 (-3.02)	-0.07 (-3.19)	-0.07 (-1.69)	-0.08 (-1.93)
I_GIT	-0.54 (-0.58)	-0.61 (-0.64)	-0.34 (-0.18)	-0.01 (-0.01)
LFA	0.20 (1.64)	0.20 (1.63)	0.12 (0.58)	0.21 (1.11)
C_SLO	0.03 (0.02)	0.04 (0.02)	-0.29 (-0.10)	0.60 (0.12)
W_SLO	-0.29 (-0.13)	-0.31 (-0.14)	-0.57 (-0.19)	0.30 (0.06)
E_SLO	-0.16 (-0.07)	-0.19 (-0.09)	-0.63 (-0.21)	0.92 (0.18)
ρ (ro)	-0.01 (-0.15)	-0.01 (-0.14)	-0.00 (-0.02)	-0.01 (-0.06)
LRT (d.f.)	16,327 (33)	16,379 (37)	6,760 (31)	3,472 (31)
LRI	0.033	0.033	0.028	0.025

Description and abbreviations of explanatory variables are presented in the Table 1

Instead of a linear relationship between the initial farm size and its growth, a more flexible specification has been used. This specification enables to detect potential differences in growth rate by different farm size classes. This enables implicit testing of previously described Gibrat's Law of proportionate effects (SHAPIRO ET AL., 1987).

Results of the likelihood ratio test (LRT) confirm overall statistical significance of all four models at 99% or higher. The determination coefficient LRI is low, which implies that none of the models can explain the relatively high share of variance within the dataset. Low LRI values are expected due to the fact that the range of relevant explanatory variables from the Census data was rather limited.

This holds for more elaborate data about production and structural characteristics of the analysed farms, indicators of their economic performance, incomes from agriculture and other income sources and similar quantitative data that might better explain the adjustment patterns of agricultural households. Same holds for qualitative factors that influence the decision-making process and may be even more important than the qualitative ones (e.g. aims relating to agricultural production, willingness of farm holders to take business risks, emotional attachment linked to agricultural production, etc.). Due to the nature of data acquisition (Census) most of these data could not be recorded.

One could expect that unobserved determinants (sample attrition due to farm exits) could have an impact to the model of farm survival and growth, reflecting in correlation between the residuals of the first (probit) and the second (simple regression) equations. Such correlation would result in biased model results. Question whether sample attrition represents a significant obstacle in the model estimation can be tested by estimation of the coefficient ρ, which represents the covariance of the residuals of the farm survival and farm growth equations (MADDALA, 1999). The ρ coefficient does not significantly differ from 0 in none of the above presented models. Sample attrition therefore does not have a statistically influence the farm growth model results.

Already a brief look to the model reveals that the explanatory variables are more successful in describing farm survival than farm growth. It can be therefore inferred that stochastic influence is greater in the part of the model referring to farm growth.

5.2 Impact of the initial farm size

The model results (Table 2) confirm that the initial farm size has statistically significant and distinctive impact on both, farm survival and farm growth. By simulating the model results with the average values of explanatory variables it can be inferred that farm size increase by one standard deviation (8.5 LU), probability of farm survival would equal almost to 1.

The relationship between size of a hypothetical farm (defined by average values of explanatory variables and coefficients of models 2, 3 and 4) and its anticipated growth is graphically presented in Figure 1. The model results reveal that farm growth is not uniformly distributed with regard to the initial farm size. Growth of small-scale farms tends to be more intensive, which can be explained by the effects of the economies of scale. Small-scale farms either cease with agricultural production or adjust their scale to the minimum efficient scale. It can therefore be inferred that the principles of Gibrat's law of proportionate growth do not hold in the case of farms in Slovenia in the period 1991-2000.

Marginal costs of production decrease with farm size. It can be therefore expected that farm growth is less distinct when the average cost curve soothes and the causes for farm growth are more of a stochastic character. It is however understandable that the effects of the economies of scale are limited by the capacity of production factors on the farm. By growth of production above this scale, average costs rise and the farm growth curve turns to negative values.

According to the interpretation of model results, the farm growth function two maximums: one at the size 3.5 LU *(V-)* and the other one at 16.5 LU *(V+)*. The curve illustrating growth of a hypothetical 'average' farm (depicted on the Figure 1 as 'all farms'), intersects the zero growth level in three pints: *A*, *B* and *C*. The growth function infers that growth of middle-sized firms converges in two directions: farms left to *B* decrease towards *A*, and farms right to A grow towards *C*.

The model results therefore reveal non-linear pattern of structural adjustment of farms with respect to their initial size. Apart from this, the above described farm growth pattern indicates that in long-term perspective, polarisation farm size distribution can be expected. If we assume that intensive structural changes in terms of further decrease of the aggregate number of farms and growth of the surviving farms will continue, the model results lead us to the finding that polarisation of farm growth and formation of a more distinct bimodal farm size structure can be expected in future. Representation of small-scale and large-scale farms in the size structure will grow. The occurrence of a 'disappearing middle' in farm size structure (BUTTEL, 1982) has already been confirmed empirically in the case of farms in Illinois (GARCIA ET AL., 1987) and Upper Austria (WEISS, 1995, 1999).

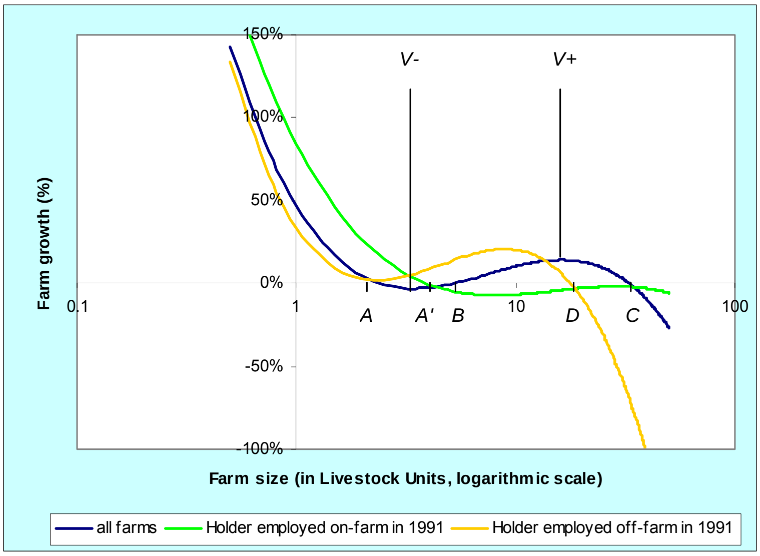

Figure 1: Level of farm growth with respect to the initial farm size

As it can be further seen from the Figure 1, there are differences in the farm growth patterns with respect to the employment status of farm holders. Estimation of the model on a sample of farms whose holders were employed off-farm, the pattern of farm growth is similar than in the case of all farms. The farm growth function converges towards zero in immediate vicinity of A, therefore at the same level of the 'minimum efficient scale' than in previous case. Differently than the growth function for all farms, farm growth does not intersect the zero growth level. The second observable distinction with regard to the whole sample is that the growth function of farms with holders employed off-farm sooner passes over to negative values (point *D*). These farms record a lower 'critical' upper limit of farm size. This result is expected, especially arising from the assumption that production resources (especially own work) on these farms are scarcer.

Results of the farm growth model for farms whose holders were employed off-farm confirm the notion of polarisation in farm size structure. Model results suggest that the fastest growth rates are recorded by (surviving) small farms, which converge towards *A*. Farms larger than *A* are expected to record positive growth, converging in long-run towards *D*.

The impact of initial farm size is less distinctly expressed in the case of farms whose holders were employed on-farm. Similarly than in the previous two cases, results of the farm growth function suggest that the fastest growth rates can be expected in the case of (surviving) small farms. The 'minimum efficient scale' on which these farms are about to operate is shifted towards right (point *A'*). The farm growth function intersects the zero-growth level only once. The growth function of farms larger than A' is negative, but rather inexpressive; the growth levels remain at levels near to zero. This infers that the initial farm size does not tend to have a perceivable impact to the growth of farms larger than A'. It can therefore be stipulated that the principles of the Gibrat's law of proportionate growth can be valid for the respective case.

The above presented findings about the differences in development dynamics of different types of agricultural households largely confirm the proposal suggested by ZEPEDA (1995), that analysis of structural adjustments in agriculture should entail separate treatment of different agricultural household types.

5.3 Impact of farm holder's initial employment status

Eventual causal linkages between the initial employment status of farm holders and structural adjustments of farms (survival, growth) have been tested by inclusion of the dummy variable referring to holders' employment status. Results of the Model 2 (Table 2) suggest that the impact of holder's employment status to farm survival is statistically significant and positive. It however has to be accentuated that the coefficients in both cases are relatively low. In case of farms whose holders were employed on-farm, the probability of farm survival increases by about one percentage point, whereas in the case of farms whose holders were employed off-farm, the corresponding probability increases by about two percentage points.

In contrast to farm survival, holder's initial employment status tends to influence farm growth only in cases where farmers were previously employed on-farm. Growth of a 'hypothetical' farm with average values of explanatory variables would be lower by 19 percentage points than in the case of such farm with holder employed on-farm.

The impact of holder's off farm employment is not statistically significant. Positive impact on farm survival and no significant impact of farm growth confirmed by the model lead us towards a finding that the holder's off-farm employment plays a hindering role in structural changes on agricultural holdings.

5.4 Impact of individual characteristics of farm holder

All presented models (Table 2) confirm a non-linear relationship between the age of farm holder and the probability of farm survival. Probability of farm survival is relatively high up to the age level of 65 years, whereas from this age onwards, the probability of farm cessation increases rapidly. Based on these results, it can be inferred that cessation of agricultural production most often takes place in the second half of life cycle, usually at the end of the working age. The cases of cessation of agricultural production in the middle of holders' life (and work) cycle are scarce.

Marked differences in this impact exist with respect to the employment status of farm holder. Difference can be perceived between the farm survival functions in the models 3 and 4. The model results suggest that the probability of farm survival after 45 years of age decreases at the fastest rate in the case of farm holders who were employed off-farm.

The impact of farm holder's age on farm growth takes a form of an inverse function. Model coefficients for holder's age are statistically significant only in the aggregate model for all farms (model 2). In this case, the model results suggest that the highest farm growth levels can be expected on farms managed by young farm holders. Due to insignificance, interpretability of coefficients in the models 3 and 4 is under question. Notwithstanding this reservation, it appears that the rates of farm growth with respect to the holder's age differ according to the agricultural household type. As it can be perceived from the comparison of farm growth functions the impact of farm holder's age appears to be the most distinctly expressed in the case of farms whose holders were employed on-farm.

The impact of farm holder's educational attainment tends to be more pronounced in the case of farm survival (Table 2). The probability of cessation with agricultural production increases with the level of farm holder's formal education. This infers that education has a significant impact on increased employment mobility of farm holders. Absence of alternative employment opportunities due to unfavourable educational structure of farm holders (SORS, 2002) appears to be one of the leading sources of immobility of their labour supply.

The educational attainment has no significant influence on decision-making about continuation or cessation with agricultural production in the case of farm holders with low education level (grammar school or less). In the case of farm holders demonstrating higher level of formal education, this impact is significant and negative (with an exception of the farms with holders employed on-farm, where this relationship is insignificant). The model results confirm the theoretical expectations that higher educational attainment increases individual's opportunity income and stimulates his employment mobility (MC GRANAGHAN, KASSEL, 1997).

A test of 'vitality' of agricultural household and its impact to survival and growth of farm holding was tested by inclusion of the data on marital status of farm holder and eventual transfer of farm ownership to another holder in the analysed period 1991-2000 (Table 2). Both determinants are statistically significant and indicate a strong impact on farm survival. This holds especially in the case of farm transfer: results of all four presented models reveal that the probability of farm survival would equal virtually to 1 if a farm was transferred to a new owner in the analysed period.

Contrary to farm survival, the impact of marital status of farm holder and eventual occurrence of farm transfer on farm growth is insignificant (table 2).

5.5 Impact of location and local labour market conditions

Population density as an indicator of physical remoteness of an area has a statistically significant and negative impact on farm survival can be confirmed in the case of farms whose holders were employed off-farm, whereas in the total sample, this impact can be confirmed at about 90 per cent level of confidence (Table 2). This result infers that the probability of farm survival is lower in the areas with higher population density. Possible interpretations of this could be that (i) cessation of agricultural production tends to be more plausible alternative in more urbanised areas which have by default more favourable conditions on the off-farm labour market, or (ii) cessation of farming is less intensive in remote areas due to rigidities on the land markets in those areas. Significance of the coefficients relating to farming conditions additionally confirms these interpretations (Table 2). These results suggest that location of a farm in an area with aggravated conditions for agricultural production has a positively impact on farm survival.

The share of active population engaged in agriculture as an indirect indicator of the development of regional economic infrastructure has a significant and positive impact on farm survival. The most plausible interpretation of this result would be that farms are more likely to stay in agricultural production in the areas with less developed economic infrastructure (and a correspondingly lower off-farm employment potential).

Different as expected are the signs and statistical significance of coefficients relating to regional unemployment level, which is used as an indicator of availability of off-farm employment opportunities. Theoretically, one would expect that the probability of farm survival is greater in the areas facing with problems related to unemployment. The model results reveal the opposite: probability of farm cessation increases with growing unemployment record. This result suggests that the social buffer role of agriculture (OECD, 2001) can not be entirely confirmed as a universal characteristic of agricultural households in Slovenia in the period 1991-2000. Survival strategies of agricultural household members are not necessarily related with preservation of agricultural production. Farm survival model coefficients for the income tax basis as an indicator of overall economic performance of the region additionally confirm this interpretation. Results of these coefficients infer that probability of farm survival is lower in areas that lag behind in the level of general economic development.

Variables describing locational characteristics and labour market conditions are less successful in predicting farm growth. Only the share of active population engaged in agriculture demonstrates a statistically significant impact on farm growth (Table 2). The model results reveal that farms located in areas with a high share of persons employed in agriculture are expected to grow at a slower rate. This result is accordant with the corresponding coefficients of the farm survival model, which infer that probability of farm survival is higher in areas with a high share of agricultural employment.

6. Discussion

Results of our analysis suggest that some long-term changes in farm size distribution can be expected in Slovenia. This is due to the appearance of two growth poles in farm size distribution, suggested by the model results. The result of polarised farm growth pattern on account of the middle-sized farms could be the 'disappearing middle' (BUTTEL, 1982) in farm size structure in the future. Furthermore, the results infer that in the future, decrease in the aggregate number of farms in Slovenia will take place in a larger part on account of farms managed by farm holders employed off the farm. However, with regard to the asymmetries in the decision-making about full-time and part-time farming empirically confirmed in another study about mobility of labour supply (JUVANČIČ, 2003) we can expect that the representation of part-time agricultural households in the farm is likely to remain constant. This gives some empirical evidence to the existing descriptive findings (KOVAČIČ, 1995; ERJAVEC AND JUVANČIČ, 1998) stating that supplementary and part-time agricultural households represent a stable structural characteristic of Slovene agriculture and that no significant changes in this respect can be expected.

The presented results also confirm existence of causal linkages between poorer accessibility of non-farm employment and continuation of agricultural production. However, decision to continue with agricultural production is not a universal survival strategy of agricultural households facing unfavourable conditions on the labour markets, but rather holds for those located in the areas with high agricultural employment (and possible occurrence of under-employment in agriculture). In these areas, agriculture tends to keep the role of a buffer to social tensions, whereas this finding can not be generalised for all areas facing rigidities on the labour market.

Besides their empirical virtue the findings pointed out above have also some policy relevance. Acquaintance with the characteristics of labour supply and dynamics of structural changes gives rise to a more effective policy planning and implementation. In order to promote economic growth of rural areas, the overall policy aim should be targeted towards creating conditions for sustainable improvement of employment structure. This will require collective effort of various policies (e.g. agricultural and regional structural policies, social and human resource development policies, etc.).

References

ALLANSON, P. (1992): Farm size structure in England and Wales 1939-89. Journal of Agricultural Economics, 45, 137-148.

BUTTEL F.H. (1982): The political economy of part-time farming. GeoJournal, 6, 4, 293-300.

CLARK, S.J., FULTON, M., BROWN, D. (1992): Gibrat's Law and farm growth in Canada. Canadian Journal of agricultural economics, 40, 55-70.

ERJAVEC E., JUVANČIČ L. (1998): Policy reform and labour adjustment; Agricultural land reform and farmland markets - the case of Slovenia. In: OECD Meeting of the Expert Group on Agricultural Policies in non-Member Countries, Paris, OECD, 28-30 October 1998, 16 pp.

GARCIA P., OFFUTT S.E., SONKA S.T. (1987): Size distribution and growth in a sample of Illinois cash grain farms. American Journal of Agricultural Economics, 64, 119-123.

GREENE, W.H., (1997): Econometric analysis (3rd ed.). Prentice Hall International, New Jersey, London, 871-947.

HALLAM A. (1993): Economies of size: Theory, measurement and related issues. In: Size, structure and the changing face of American agriculture. Hallam A. (ed.). Boulder, Westview Press, 151-203.

HECKMAN J.J. (1979): Sample selection bias as a specification error. Econometrica, 47, 153-61.

JUVANČIČ, L. (2003): Intertemporal analysis of employment decisions on agricultural holdings in Slovenia. Paper presented at the XXV IAAE Conference, Durban, 16-22 August 2003, 21 pp.

KOVAČIČ, M., (1995): Socioeconomic and size structure of farms in Slovenia in the period 1981-1991. Statistical office of the Republic of Slovenia, Ljubljana, 70 pp.

MADDALA G. S. (1999): Limited-dependent and qualitative variables in econometrics (1st paperback ed., 11th reprint). Cambridge (UK), New York, Cambridge University Press, 401 pp.

OECD, (2001): Agricultural policies in emerging and transition economies. Organisation for Economic Cooperation and Development, Paris, pp. 13-71.

RIZOV, M., MATHIJS, E. (2001): Survival and growth of individual farm enterprises in transition economies: empirical evidence from Hungary. LICOS Discussion Paper 101/2001, Katholieke Universiteit Leuven, 26 pp.

SHAPIRO D., BOLLMAN R.D., EHRENSAFT P. (1987): Farm size and growth in Canada. American Journal of Agricultural Economics, 69, 477-483.

SORS, (2001): 'AGRICULTURAL HOLDINGS 1991-2000: census dataset on structural characteristics and labour input on agricultural holdings in Slovenia'. Ljubljana, Statistical Office of the Republic of Slovenia, (electronic record).

SORS, (2002): Agricultural Census 2000. Statistical office of the Republic of Slovenia, Ljubljana, Results of Surveys, No. 777, 113-138.

WEISS C.R. (1995): Farm size structure and structural change in upper Austria 1980-90: testing Gibrat's law with individual farm household data. In: Report of the 40th EAAE Seminar, 26-28 June, Ancona, Italy. SOTTE F. (ed.). Ancona, University of Ancona, 709-728.

WEISS, C.R. (1999): Farm growth and survival: econometric evidence for individual farms in Upper Austria. American Journal of Agricultural Economics, 81, 2, 103-116.

ZEPEDA L. (1995): Adoption of capital Vs. Management intensive technologies. Canadian Journal of Agricultural Economics, 38, 457-469.

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